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THE MOTOR AGE

A WEEKLY JOURNAL OF MODERN LOCOMOTION

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FORCES IN THE INDUSTRY

THE EFFECT UPON MOTOR VEHICLE CONSTRUCTION OF INVENTIONS AND PROGRESS IN DYNAMIC ENGINES GENERALLY.—CIRCUMSTANCES WHICH OPERATE FOR OR AGAINST EACH TYPE OF MOTOR INDEPENDENTLY OF ITS MECHANICAL FITNESS.—ROLE OF AUTOMATIC MACHINERY.

The idea of applying engine power to the driving of road wagons has been very obvious ever since the invention of the steam engine. The brilliant results of the rail locomotive forced it into the background. Then it was revived in new form through the rapidly gaining popularity of the Otto gas engine for light work since 1870. The Daimler and the Benz types of gas motors became practically the foundation from which our present motor vehicle development has arisen. Then followed a rapid growth of street railway car systems from which sprang a great amount of work to perfect the electric storage battery, previously of mainly scientific interest. The work resulted in two directions: The storage battery became practical and extremely valuable as an equalizer and economizer of power in large plants and it became accepted as a convenient and in many respects excellent means for distributing "power in parcels." The wide use of electric motors for stationary purposes brought about much progress in motor construction, amplifying the resources of the engineers who applied storage batteries to street car locomotion. For this work the storage battery has, spite of energetic attempts, never proved economically equal to the trolley wire system, principally on account of the necessity for carrying the heavy load of the batteries. It was proved, however, to be well fit for other forms of traction in which economy is of smaller importance. Hence its application to pleasure carriages intended for city use.

Street Cars and Electricity.

It is largely the rapid growth of street car systems in United States which is accountable for the anomaly that electric carriages have had their earliest practical development here, although Europe with its denser population and better streets and roads would offer better conditions for their general use, were electric-charging stations as readily available there as here.

What the limitations of storage battery traction are on our mediocre street pavements, remains yet to be seen. Present results in Paris, London and New York point to a weight limit for carriage and load of about 3,000 pounds except on pavements equal to asphalt, but better results may possibly be obtained by separating the electric tractor from the carriage proper, a direction in which very little has been done.

The Return to Steam.

While these things have been going on, the production of automatic machinery and the methods of cheap and efficient manufacture by means of automatic machinery have progressed in a manner that has encouraged the construction of small and light steam engines immensely. They can be produced very cheaply to-day by means of automatic machinery. The time was when a small and light steam engine would cost almost as much as a large and heavy one. That time is past. The conditions are almost reversed; the small steam engine may be produced in a great number of small shops where machinery for producing large engines at the same relative cost, is out of question.

This has brought about a revision, and indeed a reversal, of the old verdict which pronounced the steam engine fit only for rail locomotives and for sta-

tionary purposes. And for this reason the steam engine has entered upon the motor vehicle arena with new vim, taking up the competition with the gas engine, to which the motor vehicle owes its first latter-day impulse, and with the electric motor in a most vigorous manner that promises the most interesting battle between inventors that the world has yet seen. The efforts that are being put forth for reducing the regulation of the various elements in steam engines into one function by automatic controlling apparatus for steam admission, steam generation and water feed promise a new era for steam even outside of the motor vehicle industry, to which these efforts are due. And as soon as, also, a condenser of small size shall have made it possible to operate the steam engine with a very small water supply, its advantages for certain forms of motor vehicle traffic will be undisputed.

Breadth of American Efforts.

It is almost impossible to realize to what extent the forces and ideas above referred to, which form the industrial foundation of motor vehicle work, have already taken possession of American engineers and machine shop owners. The slowness in the actual production of motor vehicles, as compared with Europe, is probably due very largely to a hard-headed and broad view of the mechanical possibilities which are opened in the new field and unwillingness to plunge into production of something so imperfect as would be the best French motor vehicles for our conditions. It is the sense of our people to do everything thoroughly in which much money is involved—if the money is their own.

And hence it is generally observed that those who would be willing to make motor vehicles on a large scale to-day prefer to obtain the money by stock subscriptions, while those who have advanced farthest toward the production of a high type of vehicle have no stock to sell, but continue experimenting very industriously in order to get within reach of the ideal which their understanding of the mechanical and industrial situation of United States tells them that it is possible to attain.

CONSTRUCTION AND PUBLICITY

As a rule the experimenter with motor vehicles is absolutely opposed to communicating with the public in regard to the details of his construction, and even the builders who have settled their conclusions in favor of a certain construction to the extent of beginning manufacture in quantity, are averse to public descriptions of any but those features which are generally recognized as public property. This means in most cases that they have no confidence in patents—for which they have usually applied—but desire to rely mainly on priority in the market and shop facilities for commercial success. They will not assist the wily imitator to secure material to work with before it is unavoidable. While one imitator may buy a sample of constructor's work, there are hundreds that will read descriptions of mechanism and study drawings of the same. And even those who might be inclined to purchase a vehicle for the express purpose of counterfeiting some of its details, will probably hesitate if they have not previously hunted an approximate opinion from other sources. Too many purchases might prove necessary before something suitable would be found. In the case of the experimenter readers of The Motor Age will readily put up with complete omission of all reference to construction details; for in an untried vehicle these details are after all nothing but theory, which gains no additional interest by being the theory of one or more persons who hope to become connected with the motor vehicle industry. The details of any vehicle which has not been publicly tested to show its efficiency and reliability may present points of interest to the student of construction, but none which may not be fully as well understood in purely theoretical fashion. The Motor Age will handle theory separately from demonstrated facts and events in so far as possible, and without reference to names of persons or firms.

In regard to vehicles which are finished, tested and actually manufactured for sale, the case is somewhat different, the public as prospective purchasers being interested in learning of the particular mechanism with which they will have to deal. It is desirable to know such mechanism fully; but not half way. The motor vehicle is an organism in which the successful operation of the whole depends on the soundness of each detail. They all co-operate. It is precisely those

to conceal as long as possible which impart value to his product if it has any. They represent precisely that which he found necessary in order to produce an acceptable value in the motor vehicle line. That which he is willing to have published broadcast represents, on the other hand, something which experience has discredited as being insufficient for motor vehicle purposes.
details which the manufacturer desires

In the absence of complete data to publish those of least importance is plainly absurd for a publication that desires to keep faith with its readers, and The Motor Age therefore discards half-blown mechanical descriptions of completed motor vehicles as unworthy of space, unless they may be accompanied with reliable accounts of tests and performances by the same vehicle of which they form part.

We fall back upon performances at races, contests and in ordinary daily use as supplying the most reliable and useful reading matter by which the public and the industry may profit.

At present very few styles of motor vehicles are actually manufactured in this country. As soon as real repetition-manufacture commences means will be found to present complete accounts of the mechanical principles embodied in them, together with drawings. But at present detailed accounts of trips and hard driving done with motor vehicles, comparisons of cost, maintenance and repairs between different vehicles as well as with horse traction, accounts of accidents with diagrams of causes and similar matter of immediate practical interest will form the main features of The Motor Age, aside from the current illustrated news in regard to manufacture, sport and pleasures pertaining to the subject.

NEW STYLE IN GASOLENE MOTOR CARRIAGES

GASOLENE MOTOR PARK TRAP

Made at Holyoke Motor Works.—Weight 2000 pounds.—For further mention see page 8.

MANUFACTURE IN NEW ENGLAND

IMPRESSIONS FROM A RECENT VISIT TO MANUFACTURERS AND EXPERIMENTERS IN THE EASTERN STATES.—MENTION OF ESTABLISHMENTS WHOSE WORK SEEMS LIKELY TO BECOME IMPORTANT IN THE FUTURE OF MOTOR VEHICLE INDUSTRY.

Probably no portion of this country is more engrossed in motor vehicle work than New England, and the writer would like to present to the readers of The Motor Age a comprehensive mental picture of all the shops in those eastern states, where wealth and mechanical insight so frequently live cheek by jowl and have united for the task of producing the American motor vehicle in the highest possible type. That any attempt to cover this territory in a single issue of this paper was hopeless because, however, at once evident by a visit to some of the shops of whose existence the writer had previous knowledge. At every one of them he was informed of some other workers in the same or neighboring towns all of whom were quietly working away at the same problem with more or less intelligence, more or less money, and more or less satisfactory results. Their number grew apace by further inquiries and it was manifestly impossible to see them all within the time at disposal.

Fortunately the readers of this paper are not vitally interested in knowing about merely experimental work, except to ascertain that it is being carried on on such a scale that if the conditions in New England were approached in other parts of the country, the total number of experimental motor vehicle shops in United States would reach high into the thousands. In reality it may perhaps be estimated that about one thousand such shops exist in United States to-day, and probably one hundred of them have been in operation for two years or longer without yet having advanced to the stage of manufacture, except in a very few instances. A considerable number who have made suitable financial arrangements are approaching it rapidly, however, and are looking around for automatic machinery wherewith to produce goods.

That a great wave of advanced construction will result from all this work seems indubitable, but it is thoroughly characteristic of the age that the majority of these workers, in the east, have small hopes of ever conducting factories under their own control. They started with this end in view, but have since realized that two factors exist which interfere seriously with the practicability of building motor vehicles on a small scale: (1) The necessity of automatic machinery—and plenty of it—for economical production is paramount and requires a large outlay of cash capital and (2) the greatest portion of the work on each vehicle is not subject to protection by patent, and the total cost of production as compared with that of competitors will therefore mostly depend on the size of the plant and the perfection of factory practice.

Their main hopes are for these weighty reasons now centered in the idea of producing patentable details of exceptional value, test the same in their experimental vehicles and disposing of them to the highest bidders, who will be found among manufacturers who can produce the entire vehicle at the lowest cost with or without the assistance of parts-makers.

The industry must be one of a high and sensitive organization, but it is of course by no means excluded that an organization of this order may be formed entirely new for the special production of a certain style or type of vehicle, if its special construction is so vital and comprehensive as to command capital upon consideration of that special construction alone. Such cases exist, but they are decidedly rare.

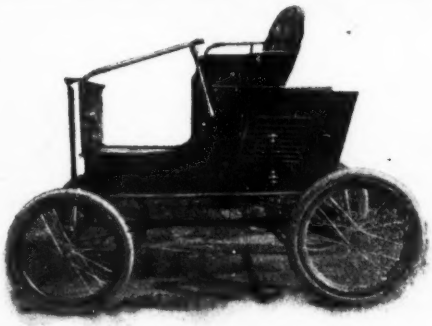
Locomobile Company's Advanced Position.

Of all the New England concerns none has attracted more widespread attention than the factory which was originally owned by the Stanley Dry Plate Company at Newton, Mass., and which is now in the hands of the Locomobile Company of America. It is generally conceded in Boston and vicinity that the Stanley brothers have shown a great deal of grit as well as business ability in pushing their construction to the front. As to the merit of the construction and the proper persons to whom credit for its good features belongs, opinions are more divided. But some of the comments made in this respect smack somewhat of envy more than of good judgment. The Stanleys have produced a vehicle which accomplishes more, if in expert hands, with a total weight of about 400 pounds than any other vehicle produced at the time when the Stanley wagon was first completed, at double and triple its weight.

Since then other steam vehicles have been produced which dispute with it the rank for general serviceability.

It has noiseless running, absence of

odor, great power for its weight and it looks neat. It may be truly said, perhaps, that the Stanleys would not have been able to produce this wagon, if Roper's experiments with a steam bicycle had not been known to them and if George E. Whitney of South Boston had not shown the way in the several Whitney wagons which preceded the Stanley. But the fact remains that, as a whole, the Stanley wagon was the first to be commercially produced which complied with the requirements of the average public. Genuine admiration is expressed everywhere in Massachusetts for the shrewdness of the Stanleys in disposing of the rights to their form of manufacture to the Locomobile Company for a large sum of money. It is held that the Locomobile Company obtained nothing in return except the priority in the field of commerce which the Stanleys had earned.



The "Orient" Steam Wagon.

The patents, yet to be obtained in this country, are usually considered precarious and the manufacture practically open to all. But, even under this supposition, the sagacity of the Locomobile Company may well be equally admired for estimating the priority in the field and the services of the Stanleys—for one year from sale—at a liberal, but by no means excessive figure. Developments have shown that priority with a marketable article is nearly everything that anybody can hope for in steam vehicle construction and that it is easily exploited at a very satisfactory profit.

When first turned out the Stanley wagon had no reverse, but it incorporated an automatic device for regulating the water feed in such manner that watching of the water glass was not supposed to be necessary. These two points have been changed.

The old frame building at Newton where part of the manufacture is carried on nestles at the bottom of two steep alley ways leading down to a court from which starts are made when wagons are tried by visitors and customers. When the writer returned to this place after a ride a horse-drawn dray was met in the alley and Mr. Stanley promptly reversed the engines and backed the vehicle uphill out of the alley to give the dray a clear passage. It is a link motion reverse.

The automatic water feed controlling device by which the feed pumps were regulated was not a success and is not used on the wagons now turned out. The driver is now required to watch the water glass. When Manager Munch at the company's New York office was asked if all the company's present orders were to be filled without any device for automatic regulation at this point, he promptly declared: "That question I decline to answer." He had previously declined to answer two other questions.

The Locomobile Company has bought the Humber plant at Westboro, Mass., the J. C. Spiers drop forging plant at Worcester and has a contract with the Mason Regulator Works at Milton to furnish engines to the full of the capacity of that concern. All of these plants are being operated at full tilt and the writer was told that the Newton factory would eventually be used for assembling only.

Where "Orient Automobiles" are Made.

Another busy hive of activity is the Waltham Mfg. Company's plant at Waltham. There is an air of liberal thought and earnest work over the automobile departments of the company over which Mr. Metz presides, that promises great things for the future. The spacious yards present a lively picture occupied as they are, almost constantly, with a throng of people desirous of trying a ride in the small motocycle four-wheelers and tricycles furnished with De Dion-Bouton motors, which the company has taken up for this class of vehicles as being undoubtedly the pattern which has earned the greatest popularity in all European countries. As such it should be a path-opener here. The motor tandem pacing machines provided with these motors which the company has placed on the race tracks are already well known, and the reputation of Mr. Metz as an original and reliable constructor in the bicycle field leaves no doubt that the "Orient" motocycle production will be in the van in the immediate future, starting as it does from the best European patterns and modifying these gradually as experience shall dictate.

At the Waltham race meet which took place during the L. A. W. convention in Boston last month, the Waltham company's new steam carriage was shown off to great advantage. It proved itself a docile instrument in the driver's hands and provoked very favorable comments from the spectators by its pleasing ap-

pearance. The accompanying engraving fails to show one feature which won general approval: it is larger than most of the other steam carriages and the driver sits higher.

This carriage has been evolved from the pattern first turned out last year by Messrs. Piper & Tinker of Waltham, but nothing is left to remind of the awkward outlines of that first wagon. Mr. Tinker showed the writer many of the details of construction, but does not wish to have them publicly revealed as yet. The boiler is of about 8 horse-power capacity and of the tubular variety. Several of Mr. Metz's ideas are incorporated in the construction, and among them a compensating gear of undoubted merit. Preparations for manufacture of this wagon, which it seems should be very satisfactory to anybody with sufficient mechanical insight to take proper care of a steam wagon, were being pushed to completion

Orient Motocycle Four-Wheeler.

last month and have probably advanced to a point that should interest intending purchasers, by this time.

Not satisfied, however, with two forms of automobiles the Waltham company has also completed an electric runabout and in the experimental department a one-cylinder gasoline wagon is being constructed by Mr. Anderson, an employe of the company who is proceeding on original lines of design by which great simplicity is aimed at. No chances are overlooked and talented workmen are given an exceptional chance to develop valuable ideas at the company's expense.

In the village of Waltham another company is making steam vehicles. It is now known as the New England Motor Carriage Company, but is closely affiliated with the company, making the Comet bicycle. The constructor is Mr. Skerry of Waltham. Important advantages are claimed for the latest type of vehicle which has been turned out, but the writer had no opportunity to see it in operation. An older pattern was demonstrated in operation on a loft in Boston. It seemed to be slow in regard to the first generation of steam.

Atlantic Company's Aggressive Work.

Among other makers of steam vehicles in the vicinity the Marsh brothers of

Marsh Brothers' Steam Wagon.

Brockton claim public interest by the advanced stage which they have reached and by a construction varying widely from that of other makers. Their experiments have been carried on extensively in the building shown in illustration which is equipped with all the necessary machinery for original work. The com-

Boiler in Marsh Wagon.

pany has recently been reorganized under the name of the Atlantic Automobile Mfg. Company with a capital stock, un-

der Maine laws, of $500,000, Horatio Adams of Boston, president, and E. H. Reynolds of Brockton, treasurer.

The Marsh brothers do not consider the tubular boiler of small dimensions thoroughly satisfactory. While admitting its value for rapid generation of steam they have found it less durable than required for vehicle work. Their preference is the

Atlantic Company's First Shop.

helical water tube boiler of the pattern shown in the accompanying illustration which permits the water to circulate freely and permits expansion of the tubes without tendency to rupture and leakage at joints. In this preference they have followed the example of the United States government which employs this style of boiler in light torpedo craft. A pair of compound cylinders, utilizing the exhaust once, permits the vehicle to travel farther than the ordinary steam wagon with the same amount of water.

The Marsh vehicle is low-built and weighs about 550 pounds. It has been tried on the road to the complete satisfaction of its builders, bearing up well under severe handling, although no adequate spring support was provided in the earlier models. When the writer visited the plant in the middle of August, a new wagon was under way with which it was the desire of the builders to establish a speed record between Boston and New oYrk, if possible in a race with one or more motor vehicles of different make.

Two Promising Experimenters.

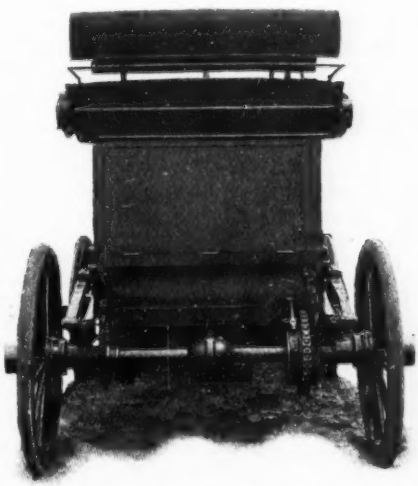
The Bramwell-Robinson company at Hyde Park, Mass., is another concern from whose experimental work there is reason to expect rseults of interest to the public in the way of manufacture within a short time. It has a machine shop of considerable size at disposal and Mr. Bramwell's construction was said to have been tested and to have shown up well.

A similar position is occupied by the Heyman Motor Vehicle Company of Melrose, Mass., where a gasoline vehicle, nearly finished, was shown the writer. While no trial could be made, it was noticed that the construction and workmanship compared favorably with the majority of similar vehicles and embodied features in regard to speed control which are original with the makers. Tests of the vehicle will be looked forward to with interest.

It is not the intention here to give a list of all who build steam or gasolene wagons in New England or even of those who have already made and sold a number of vehicles. Of such there are several, but it seems more than doubtful for the majority of them if they can compete in the open market when the firms here mentioned shall be ready to manufacture.

Whitney Manufacture Parceled Out.

A peculiar position is occupied by George E. Whitney. His steam vehicle is by many considered a very desirable type. It is manufactured in South Boston under Mr. Whitney's own supervision and a wagon of this pattern was recently taken to England, where it created great enthusiasm. A carriage substantially similar to it is made at Lawrence, Mass., and is known as the Stanley-Whitney carriage, being manufactured by a firm who, spite of the identity in name, has nothing to do with the Stanleys at Newton. They are identified with the cotton-spinning industry at Lawrence. It



Holyoke Park Trap, Rear View.

is understood that they have a batch of 100 carriages under way.

At Everett, Mass., there was found another firm making Whitney carriages under the name of the Everett Motor Carriage Company, but this firm has decided to abandon the manufacture of complete

vehicles and confine their attention to boilers and engines for motor carriages. The style of the firm is now Milne & Killam.

Eaton Represents Electricity.

The electric branch of motor vehicle work is not strong in Massachusetts, the Boston companies being mere commercial feeders to the manufacturing syndicates licensed by the Philadelphia Storage Battery Company, with the exception of the Eaton Motor Carriage Company, who have a factory at 8 Waltham street, Boston, and expect to turn out carriages of their own design.

The Holyoke Motor Works.

A carriage which invites strongly to close investigation of details is the motor park trap made by the Holyoke Motor Works, of Holyoke, Mass., Charles R. Gruter, proprietor. It weighs 2,000 pounds and is driven by a two-cylinder gasolene motor, which is said to develop seven-horse power by fly wheel test. It has a number of features in design that distinguish it from the ordinary gasolene vehicle, and The Motor Age hopes to present to its readers a complete record of scientific tests to which the carriage has been put in the interest of capitalists who are contemplating purchase of the right to manufacture under the patents secured by Mr. Gruter. Several other styles of gasolene vehicles have been built by the latter. It will be noticed from the engravings that he employs helical emergency springs on the wheel axles, which supplement the action of the leaf springs. The steering mechanism is special and is proof against any tendency to turn that may arise from obstacles in the roadway.

Baker's Infallible Motor.

One of the most interesting and also most promising of all gasoline motor constructions were seen at Hartford. H. C. Baker, the founder of the National Machine Company of that city and connected with its management for nine years, has for the past three years given his undivided attention to gasolene vehicle construction and has secured patents on his motor embodying 26 claims in nine countries and another with 24 claims on other parts of the mechanism. He set out to make the gasolene engine in every respect as completely reliable as a railway locomotive, and finds that the unreliability in previous forms of gas engines is due solely to, 1, variations of the explosive mixture beyond control of the operator; 2, defects in ignition, and 3, unreliability of valves.

These factors he has reduced to absolute uniformity, subject to adjustment, by abolishing all valves and by measuring the liquid gasolene to be used for each explosion in each of the three cylinders in his motor with exactness. The quantity is determined by the length of the piston stroke of a diminutive pump. All valves are supplanted with a rotary piston which by its rotation brings inlet and exhaust ports in connection with the three cylinders with mathematical precision and in due order. The liquid drop of gasolene is delivered into a narrow channel, the entrance-opening being closed flush with the inner wall of the channel by the piston which carries the fluid before it. By the suction stroke of each cylinder air is carried through the channel, which is further narrowed where the liquid is deposited and absorbs all of the liquid as vapor, passing thereafter into the cylinder. Mr. Baker has tested the reliability of his methods by loading his motor until the fly wheel would turn at a minimum of speed while adjusting the charge and the time of ignition at the points of the highest efficiency. The motor would under these severe conditions continue to revolve uninterruptedly at the lowest speed. It would go on indefinitely, he states, but if then he changed the time of ignition in the least, the motor would stop. Also if he changed the charge of gasolene in the least, the motor would stop. If he diminished the load it could be started with the new charge of gasolene or with the new ignition. But under all circumstances he found that he had to deal with absolutely constant factors at any one set of adjustments of his mechanism and that he obtained constant results. For these reasons he expects that his motor will prove a genuine surprise to the world, for nobody has yet seen another gasolene motor for which this degree of reliability could be successfully claimed.

In next week's Motor Age other observations made in New England and New York will be chronicled.

THE CROUCH STEAM WAGON

HUGH DOLNAR'S DESCRIPTION OF POWERFUL EXPERIMENTAL WAGON BUILT BY W. LEE CROUCH OF BALTIMORE.—COMMERCIAL MODEL WITH AUTOMATIC BOILER FEED REGULATION AND IMPROVED WAGON FRAME CONSTRUCTION PROMISED.

Among the builders of steam engine carriages in the United States nobody holds a higher position in the estimate of engineers than W. Lee Crouch of Baltimore—formerly of Pierce & Crouch, New Brighton, Pa.—and it is commonly believed by motor vehicle investigators in the eastern states that this concern will rapidly take front rank as soon as its arrangements for manufacture on a commercial scale shall have been completed.

This opinion seems principally to rest on the high efficiency and strength of the Crouch engine in proportion to its weight and the highly workmanlike manner in which he has gone about producing a very high power within the limited space afforded in an ordinary run-about.

Whether the Crouch wagon will conform to popular requirements as well as its prototype comes up to the ideals of the engineer remains a question of great interest, but one on which The Motor Age cannot yet supply the desirable information.

High Power of Small Engines.

Hugh Dolnar, whose contributions to the motor vehicle department of the Cycle Age were widely read, writes of the Crouch experimental wagon in part as follows: So far as my knowledge goes, the pair of simple engines which drive the Crouch wagon are the most highly organized of any toy size steam engine ever constructed anywhere, and I doubt very much if the world can show another pair of small engines that can develop a horse-power with so little weight of steam per hour, as the water consumption of the Crouch engines falls inside of 18 lbs. for that effect, which is something almost incredible for such small cylinders in intermittent service, such as the driving of a road wagon must always be.

Running Gear Experimental.

The running gear of the Crouch wagon is as raw as his motors are refined, the bearings being all plain sliding surfaces, and nowhere covered from dust, or made self-oiling. This makes no difference with driving this wagon, which has possibly as much as fourteen horse-power available, and would turn its wheels out of its pneumatic tires inside of a minute, if it were given the use of its full motive force on a level. This wagon has been used to draw a trailer, although, in my opinion, its driving wheels are wholly inadequate to such service, and its enormous over-powering makes it seem a wonderful machine to those not specially trained in motor observation.

Automatic Feed Pumps Promised.

The Crouch boiler is a nest of vertical helix bent tubes, precisely in the manner of Gurney, A. D. 1825, though much in the form of the present "Lifu" boilers, with which all students of the automobile of to-day are quite familiar; this boiler carries steam at from 250 lbs. to 300 lbs. pressure, and delivers this urgent fluid to the engine cylinder jackets superheated to a temperature of from 700 to 800 degrees. The live steam jackets wholly surround the cylinder, this being made possible by locating the steam distribution valves in the cylinder heads. The valves are of the unbalanced puppet variety, and the pistons travel to within one sixty-fourth of an inch of the cylinder heads, so that the total clearance space is well inside of one two-hundredth part of the piston displacement. The cut-off is hand adjusted from zero to three-quarter stroke, and is of the instantaneous drop variety, cam-operated, this mechanism being made possible by the extreme lightness of the valves and parts to be moved, and by the use of hardened tool steel actuating members. The pair of cylinders are each 3in. diameter by 6in. stroke, at least twice as powerful as they should be for the vehicle in which they are employed, and as Mr. Crouch is a very skillful driver, I rode with him in an agony of apprehension and constant begging on my part for slow speed, which kept the rate inside of twenty-five miles per hour, I think, during our journeys over the fine hilly drives of Druid Hill Park, Baltimore, on Friday, May 27th, 1899. On a subsequent occasion the pump valves did not work well, and Crouch pumped the boiler up by hand, against 200 lbs. pressure, on a warm morning. Crouch explained to me with much earnestness that in the yet to be constructed commercial model of his wagon there would be a pair of boiler feed pumps, with mechanically-actuated valves, which would obviate the necessity for such warm weather work.

The Crouch wagon framework consists

of an underneath rectangle composed of the front and rear axles to which widely separated side bars of steel tube are jointed. The three elliptic springs, two in the rear and one in front, are secured to the axles, and carry wooden bolsters on top of them, and these bolsters support an upper rectangular frame of steel tube, which supports the boiler and engines, and is braced by two diagonal members which are journalled to the rear axle, and reach upward and forward to the pillow blocks of the engine crankshaft, at the extreme front of the wagon body, under the driver's footboard. A long roller chain, 1 1-8in. pitch, hard rollers, made by the Boston Gear Works, leads from the crankshaft to the rear axle. This chain runs from a cast-iron sprocket of sixteen teeth on the engine shaft to a cast-iron sprocket of twenty-four teeth, forming part of the compensating gear ring, thus making the gear reduction one an a half to one only, which is ample with such large engines.

Draws Water by Syphon.

The steering is by a bicycle handlebar, and the driver has under his care

Crouch Factory in Baltimore.

the brake treadle, the cut-off lever by which speed is regulated, the throttle valve wheel, the fuel valve wheel, and the live steam jet for urging the fire. Twelve feet of hose, coiled on the footboard, is connected to the water tank by a steam syphon, so that, by dropping the free end of the hose into a water supply, the driver can very quickly fill the water tank without leaving his seat. The exhaust is silenced by delivery through forty holes, 3-32in. diameter, and at no time did I see any appearance of exhaust steam from the wagon when in action.

The wheel gauge of the Crouch wagon is 54in., and the wheelbase is 60in. The rear axle bearings are 35in. from center to center.

The boiler is made of ordinary steel tubes, 13-16in. outside diameter by 5/8in. inside diameter, and has about thirty-five square feet of heating surface, and can deliver a brake horse-power for each two and a half square feet of heating surface. The ordinary evaporation is about 120 lbs. of water per hour, extreme 200 lbs., with a fuel consumption of from one and a quarter to two gallons of gasolene or kerosene per hour. The burners are a pair of Bunsen's, with opposing and impinging flames, and make only a very little noise, hardly to be noticed. The combustion is good, no smell being perceptible on the road.

Fire Governed by Hand.

While Stanley and Whitney place the fire under automatic control by the use of the steam-actuated diaphragm, and carry the water in the boiler by hand regulation, Crouch carries his water by a float in a water column outside of the boiler casing, and governs his fire by hand. The diameter of the Crouch boiler casing is 13½in.. outside, its total height is 36in., and its lower end is 22in. above the road surface; the total weight of the boiler and water column is about 120 lbs. empty.

The wagon, with water and fuel on board, weighed 1,040 lbs.

Crouch, in his commercial model, will use vertical cylinders and a short chain drive, possibly cylinders 2½in. bore by 5in. stroke, with a two or two and a half to one ratio of reduction from the engine-shaft to the driving wheel axle, and will probably place both water and fire under automatic control.

MINOR MENTION.

The Oakman Motor & Vehicle Co., Greenfield, Mass., lately organized with a capital of $5,000,000, contemplates the erection of its main factory near Philadelphia. The Greenfield plant will be retained.

The Howard H. Brown Automobile Company has obtained title to the property of the Elgin Sewing Machine and Bicycle Company and is arranging for additional machinery.

E. N. Winship and others are organizing an automobile manufacturing company at Napa, Cal., to produce vehicles under Charles E. Duryea patents.

The League of American Wheelmen harbors a plan for inducing all owners of automobiles to join under its banner for the good roads movement.

John Lonn & Son Company of LaPorte, Ind., is getting ready to enter into motor vehicle manufacture.

In Berlin an electric omnibus service has been instituted, but it is restricted to asphalted streets.

LIQUID AIR FOR AUTOMOBILES

WAVE OF COMPANY PROMOTION AND EXPLOITATION OF PUBLIC'S FAITH IN THE WONDERFUL.—LIBERAL USE OF MAGIC WORDS.—ARTIFICIAL ADVANCE IN STOCK QUOTATIONS.—ALL THE PARAPHERNALIA OF A NEW KEELY MOTOR MOVEMENT.

Boston, Sept. 1.—The enthusiasm for motor vehicles is great in New England. Especially among those who expect to coin it into money. They are the germ-breeders of the enthusiasm, who are nursing a real boom through a frenzied show of confidence in the automobile. They are at the same time those who are in the best position to know that the confidence is artificial.

The situation is therefore not incumbered with too much sincerity. But there is no doubt that the automobile or motor vehicle idea has "caught on."

Everybody feels assured that motor vehicles are coming and company promoters are benevolently undertaking the task of explaining when and whence they are coming. And out of a thousand persons who feel convinced that something must come out of the hubbub, there is a percentage who may be induced to subscribe their names to an application for stock in some particular concern whose promoters are willing to swear that the great money-making stroke is inseparably bound up with the mechanism which they have in tow.

The wave of company promotion runs a great deal higher in New England than that of actual manufacture. There are indeed hundreds of experimenters and workers who are building self-propelled wagons in and around Boston, but they are not manufacturing—with one, at most two, exceptions. They have barely reached the point where they feel warranted in buying machinery for economical mass-production. And the better man and mechanic the builder is the farther he finds his production from the point of perfection that he set out to reach. The less willing is he to entrust his commercial fortunes to the tender mercies of financial brokers.

The Precarious Basis of Valuations.

Secrecy, "personal magnetism" and magic words are the levers mostly operated to induce the public to accept the blessings of immensely valuable automobile company stock at 25 cents on the dollar. The dollar is of course neither gold or silver. It is capitalized invention. The value of the invention is first marked up by hope and greed and vision and is then marked down for the small investor's benefit by impecuniosity and lack of ability to convince the really hard-headed men who control gold in quantity.

Gold in driblets comes more easily. It has an affinity for advertised words and mysterious forms of power.

Of all the magic words "liquid air" is today the strongest. It draws into a charmed circle of hasheesh-laden atmosphere all the smart gentry who have succeeded in getting a little money ahead at the cost of fellow-beings and whose ideal it is to get something for nothing.

This word is being exploited these stirring days in Boston by the Liquid Air, Power and Automobile Co. of Boston. It sounds well and round. It was an artistic mind that got those three magic words in juxtaposition. There is rhythm of vowel sounds as required by the poets. There is a suggestion of superhuman insight in forces that are beyond common comprehension. It is a fin-de-siecle enterprise. Liquid air harnessed to money making for the first time. Think of it! Common scrub investors permitted to enter on the ground floor of an epoch-making gigantic monopoly.

The company is doing considerable advertising all over the country to sell "a limited amount of its stock at $2.50 per share, par value $10, full paid and non-assessable." Right reserved to advance price. And at last reading it was advanced to $3. Why not?

A Question of Facts.

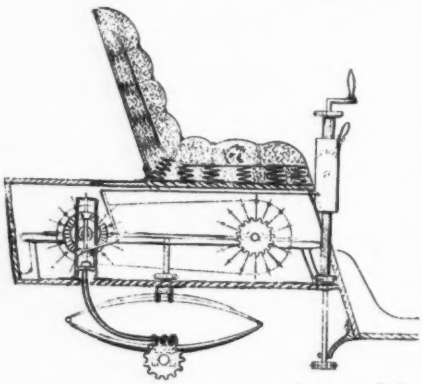
Nobody will deny that there may be developed useful applications for liquid air. The question for the investors to decide is whether the Liquid Air, Power and Automobile Co. of Boston has developed them or merely hopes to develop them.

The writer called at the spacious Boston offices recently in quest of information. A person with an audacious face and a freshly acquired vocabulary undertook to furnish the desired information, though, as it proved, with certain convenient limitations which were explained by the remark that "he was not a mechanic or familiar with the technical side of the inventions."

It was not possible to see the completed carriage referred to in the company's prospectus, although the factory is supposed to be at Cambridge, but a nice aluminum model ("aluminum" is one of the minor magic words; it ranks

about equal with "electricity" for stock selling purposes) was shown of a power transmission and speed change gear, the same that is shown in elevation in the carriage box in the accompanying illustration.

It consists of an arrangement by which a pulley on the engine shaft may be reduced in circumference at the same time as a pulley on the countershaft is increased in circumference, or vice versa. It looks pretty, but as the pulley surfaces consist of cross-bars the intervals be-



THE CYCLE AGE

tween which vary largely according to the size to which the pulley is expanded, it seems very mysterious how the pulleys are to be connected. Neither a belt or a chain would do; nor would a belt with projections reaching into the interstices at all answer the purpose. The guide, however, seemed to think that the latter arrangement would do, oblivious of the fact that he should know about this if the company's first carriage had been completed.

Flexible Shaft in New Role

Now, strange to say, the company has the hardihood of presenting in its prospectus a picture of its carriage—halftoned from a drawing—in which there is shown a flexible shaft connection from this fanciful transmission and speed change gear, and this flexible shaft is connected with a worm gear to a spur gear on the rear axle of the vehicle. That is the proposed driving mechanism. The power, according to the explanations offered, is generated by liquid air, which is allowed to escape in some manner from a tank and is led through coiled tubing where it is "superheated" by means of an electric device, so that it is finally led into the diminutive engine in gaseous form. The electric heat generator was shown in a "don't touch me" manner by the guide and is sufficiently small in size to be mysterious. To wring particulars from the demonstrator proved impossible. Neither was anything shown to indicate how the company takes care of the expansion of the liquid air in the coils at the moment when the transition from liquid to gaseous form takes place.

A few extracts from the prospectus are of interest. It commences auspiciously as follows:

Steam and electricity, giants both as they are, have had their day.

As motive powers they are on the eve of eclipse; the latest and greatest discovery of all, liquid air, is the world's mightiest marvel, and even in its infancy has demonstrated its ability to outdo both.

Steam and electricity, each in its turn, created a revolution of advancement in civilization, comfort and convenience to mankind, and have contributed enormous wealth to those who developed them; but their fields were and are limited when compared with the transcendent possibilities of liquid air, whose power is not only on the earth but above it and beneath the sea as well.

Much has been written of this newly-discovered force, but it has thus far been considered principally as an agent for refrigerating purposes, or as providing a healthful atmosphere for hospitals and sick rooms. True enough, it was available for little else until the proper harness was discovered for it to work in; but now, with the inventions of George Code, Hans Knudsen and Milton Chase to control and apply it as a motive power, its possibilities of usefulness and profit admit no bounds less than those of the firmament above.

The Genius of Two Continents.

Who has ever heard of Hans Knudsen of Vamdrup, Denmark, vice-president of the concern? He seems to be a trump card, representing together with George Code of Boston and Milton Chase of Haverhill, Mass., the "genius of two continents." The writer did not see the two latter, but he saw Mr. Knudsen. He is a rustic-faced man, who speaks his own language with a decidedly bucolic accent. Vamdrup is a village on the boundary line between Denmark and Germany.

Five Horse-Power from Two.

Here is another extract that speaks for itself:

The Liquid Air, Power and Automobile Co. is an alliance of the best inventive genius of two continents in the production and application of liquid air and the manufacture of power machinery and automobiles.

For lightness, freedom from annoyance and noxious odors, and unequaled controllability, liquid air is the ideal power for automobiles; and our "Peerless" is the handsomest, lightest, cheapest and in every way the most desirable motor carriage ever produced. We herein show (on page 4) the design of our "Peerless" motor No. 1, together with sectional views of same showing position of the power transmitter, which invention enables us to secure five horse-power from two.

An Important Economy.

Speaking of the profitability of its enterprise the company delivers itself of the following mouthful:

Beyond the plant necessary to produce liquid air, there is practically no expense, the atmosphere being the only material to be worked upon, and that itself in our apparatus used over again, thus still further re-

ducing the cost of production. The sole expense is the interest on the money invested in the plant and the wages of the workmen. The possibilities of profit beyond these charges are only limited by the demand, which is increasing more rapidly than in any other industry ever known.

The saving so amusingly effected by using the same portion of the atmosphere over again shows the infinite care that has been given to details in the interest of investors. Does the company expect that there will be a charge for atmosphere in the future, or is it simply that the pen of its prospectus-writer slipped into idiocy by the ready flow of words?

Throughout, the prospectus is a gem of its kind. If it contributes to the sale of the company's stock it can only be on the theory that it is "impossible to overestimate the stupidity of mankind."

SCRAMBLE FOR PATENT CONTROL

Last month rumors of a trust or combination to control the production and sale of gasolene motor vehicles and the patents applying to this large branch of the automobile industry, were persistently afloat in New York, being confirmed and denied alternately by the officers of companies which are not yet in condition to manufacture.

To aim at control of as many patents as possible has become the fad among prospective manufacturing companies. Since it commenced to be realized that hardly any one patent held fixed rank and value in the estimate of financiers, security is being sought in the possession of a multitude of them or in combinations of the patents severally owned by a number of companies.

Very little progress is made in this direction, however, as no agreement on values can be reached.

One of the reports went into details as follows:

> The American Automobile Company has been organized in New York to control the manufacture and operation of all the automobiles and motors in which kerosene or gasoline is used in the United States, France, Germany and other countries in continental Europe.
>
> The new corporation is to be financed by the Colonial Trust Company. Back of the corporation are said to be Wm. C. Whitney, P. A. B. Widener and Thomas Dolan, of Philadelphia; United States Senator S. B. Elkins, of West Virginia; Joseph Leiter, of Chicago, and others. The new combination takes in the Automobile Company of America, the Winton Carriage Company, the National Motor Carriage Company and the Manhattan Motor Carriage Company. Between them these concerns control sixty-five foreign and domestic patents for the use of gasoline, kerosene and all oils applied to automobiles and motors. The company is to be capitalized at $10,000,000, of which $4,500,000 will be in preferred stock.

This has all been denied and discredited since. Of all reports there remains only the acknowledged fact that most of the heavily capitalized companies, whose stock is partly in the open market, endeavor to offer investors the additional guarantee of a safe investment, which the control of many patents is supposed to convey, especially if these patents cover more than one general type of vehicle construction.

In this respect the American companies follow the example set by Harry J. Lawson, who formed the British Motor Company with the intention of controlling the entire English industry by early acquisition of rights in every valuable feature of construction.

The American followers of this plan are at a disadvantage in being much later on the field and are therefore operating with much smaller chances of success. But even the British Motor Syndicate, as it is commonly styled, is finding it exceedingly difficult to make the British industry accept its dictation. The patents which this company has not acquired are generally considered of greater aggregate value than those which it controls, and new ones of high specific value for certain styles of vehicles—the industry is being specialized more and more—are being issued to persons who refuse to sell and have them shelved by the high royalties demanded by the B. M. Co.

Correspondents to the British technical journals have lately waged a merry war on the British would-be controller of patents and their contributions furnish a valuable indication of the small prospects that exist for enacting a similar proceeding in this country and putting the gasolene and petroleum motor industry under tribute to any one concern or combination of concerns.

One of these correspondents who defies the company to collect royalty demanded of him concludes tersely:

> If the British Motor Co., Ltd., hold valid patents covering the De Dion and other mo-

tors they are justly entitled to a royalty, but the mere fact that they hold patents and have paid large sums of money for them does not make them valid, and this is the crux of the whole matter.

Another writes as follows:

Mr. J. H. Lawson informs us that his company shortly intends issuing a technical and lengthy list of the famous "master patents" which have played the sword of Damocles long enough, to the detriment of the industry. Whenever these patents have been questioned, the answer of the B. M. Co. has been of such a nature as would lead us to suspect a Spanish strain in the blood. "To-morrow," or "next week," or "our officials are so busy," may be polite answers in their way, but they do not give satisfaction when manufacturers are honestly endeavoring to discover whether they are infringing or not. Of course, the reply of the B. M. Co. is, "Certainly, you cannot build a motor or car without infringing,' which, as Euclid tersely remarked, is absurd.

The B. M. argument seems to be this: "We have spent enormous sums buying patents, and as they were all we could get at the time, and comprised all the then known systems, they must be all right, and no one can build a car unless they infringe"—an argument palpably thin, inasmuch as the inevitable progress is not taken into consideration. The company is always careful to add that it is "still buying inventions." It may be, but it is not buying them all, and unless it does acquire every invention tending to the perfection of the autocar the argument still remains thin.

The fact of the matter is that there are no master patents in the true sense of the term. The principal patents held by the company are mostly detail improvements, and we will glance through some of these before finally leaving the subject, but we ought, before going any further, to consider a statement that has been made by responsible officials of the company on one occasion at least. "We shall stop anyone putting a motor on a tricycle." We will merely turn up an abridgment in the year 1880, and we find that a provisional specification was taken by L. Hardaker for "motors and mechanism for driving velocipedes," 2,290, 1880. Here we have a motor and tricycle combined clearly set forth. It was, as a matter of fact, a hydrocarbon engine, and claimed electric ignition of the charge and an arrangement for throwing the pedals out of gear.

It is the Dion and Daimler patents which are of most interest just now, and it is significant that up to the present Messrs. Dion and Bouton have taken no material steps to uphold their rights in France. It is certainly not for lack of opportunity, and one firm at least that is making a successful tricycle motor is prepared to send its tricycles to England under a guarantee of freedom from liability under the Dion patents. This is such a serious matter that we are drawn to the conclusion that the term "master patent" in relation to the Dion system is an error in terms. Messrs. Dion and Bouton are wise to rely on their acknowledged excellence of manufacture rather than on doubtful patents, not that theirs are more doubtful than those of Smith or Brown, but "patent" and "doubt" should be synonymous terms. There is also an English firm giving a similar guarantee.

Taking now some of the Daimler patents, we will just endeavor to find if any of them are of such a nature as to be absolutely necessary to the success of any car, or of such a broad character as would justify the term "master patent."

Here the correspondent gives a brief description of each of 45 of the British Motor Company's patents together with a characterization of each, and he continues:

The foregoing is not a complete list, as patents have doubtless been acquired since the publication of the prospectus, but we can take the specifications considered as fair examples of the whole. If the B. M. Co. at the time of its formation had made it worth while, every intending manufacturer would have taken a license to use the B. M. patents rather than experiment, but not only was the royalty—£5 per horse-power, minimum £10 per motor—ridiculously high but the terms of the license would have made made him a slave to the company for twenty years. Since then we have seen a copy of a license with, we believe, five per cent. royalty, but then, again, there was the obnoxious binding clause, with a possible "get out," i. e., "should appointed arbitrators decide some new systems better than those of the B. M. Co." The B. M. Co. must remember that the fact of paying £1 for a 1d. article does not justify their attempt to make other people appraise the article at a corresponding valuation.

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SPRING DRIVE FOR FREIGHT VANS

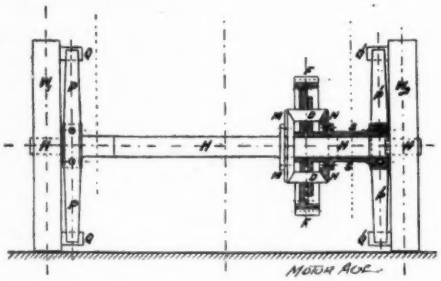
In heavy motor vehicles such as electric carriages and in freight motor wagons of any type the injury to which transmission gear and tires are liable by sudden stops or shocks has always presented many difficulties.

In electric vehicles it has been tried to overcome them by supporting one end of the motor on springs, but not with entire success.

In one of the heavy freight wagons which ran successfully at the recent trials managed by the Self-Propelled Traffic Association of Liverpool, England, a spring drive was employed which the Autocar illustrates and describes as follows:

A double helical pinion on the countershaft gears with the similarly-toothed ring F F, which encircles the differential or double driving casing, and drives the beveled pinions D D, which in their turn drive the beveled wheels M M and N N. The balance gear in itself presents no

unusual features, but it will be seen that N N is not directly connected with the main (unbroken) axle H H H, but to a sleeve S, which encircles it. On the other hand, M M is fixed to the main axle. The two rear wheels W1 and W2 are also not directly connected with the axle H (or sleeve S), but are free to revolve on it.



Elliptical plate springs P and P1 are bolted to the axle H for the left wheel, and the sleeve S for the right wheel, and the power is transmitted through them to the rims of the two road wheels. Suitable lugs Q Q and Q1 Q1 are bolted to the rims of the wheels, and thus the power is applied to the rims, and not the hubs, of the road wheels, and not only so, but it is applied gradually, as the balance-geared axle partly revolves in the wheels when power is applied before the wheels themselves commence to revolve or the vehicle to move. It will be seen at once that this provides a very excellent method of gently introducing the engine to its load, and, besides, minimising the starting shock, allows the wheels to meet obstacles when running without imparting a dead shock to the gearing or engine. The arrangement strikes us as entirely novel and efficient. Of course, some power is lost in compressing the springs, but on a give and take road this is given back, and a certain amount of "life" is imparted to the moving mass, which could not exist with an ordinary rigid method of transmission. Last, but not least, the road wheels themselves are saved quite as much as the engine and gearing.

PORTS INSTEAD OF VALVES

A petroleum gas motor has been perfected by George A. Whitcomb of Framingham, Mass., in which a rotary piston, that also has the motion of the ordinary reciprocating piston, takes the place of the poppet or needle valves usually employed for securing admission of explosive mixture and exhaust of the products of combustion.

In this respect the Whitcomb seems to have points in common with the motor designed by H. C. Baker of Hartford, Conn., and referred to on another page in this issue, but the rotary piston employed by Mr. Baker is purely rotary and has no reciprocating motion.

The Whitcomb motor, it is stated, may be operated with one or more cylinders, in the latter case allowing a considerable horse-power without recourse to water-jacket for regulation of the temperature. Mr. Whitcomb offers his patent for sale.

STANLEY WAGON IN FRANCE.

A cablegram to the New York Herald announces that the American Automobile and Motor Company, Limited, has just concluded a very important contract with the Locomobile Company of America, of which A. L. Barber is president. The company has acquired all the rights of the Stanley automobile.

Vicomte de Jotemps is the general manager, with offices at 47 Boulevard Hausmann.

The French company, it is stated, will absorb about one-half of the production of Stanley steam wagons, of which the Locomobile company is capable.

TEN READY FOR DELIVERY.

The Graham Equipment Company of Boston advertised recently that it had ten steam carriages which could be delivered immediately upon order. The carriages were built upon the general design of George E. Whitney steam wagons as made at Lawrence, Mass., and in several shops in that state, except that the engine part in the Graham carriages seems to be supported on the running gear independent of the wagon box, probably by means of the Graham spring suspension method.

ATTRACTION FOR COUNTY FAIRS.

Mr. Snow, of Wyoming, Ill., has purchased one of the new Duryea four-wheeled motor wagons made by the Peoria Rubber Mfg. Company and is making the circuit of county fairs in central Illinois to exhibit the wagon to the farmers. At Galesburg it is Mr. Snow's intention to have a race with Dr. Morris of that town, who owns a motor vehicle of another make.

HEAVY CABS NOT PROFITABLE.

The 6,000 pounds electric cabs in Paris have been withdrawn from service at the usual cab rates, which were high enough to make horsedrawn cabs profitable. They will be used at trip rates, however. London's electric cabs, which also weighed about 6,000 pounds, were also taken off the streets a short time ago.

RULES FOR RACING CONTESTS

THE LEADING FRENCH CLUB FORMULATES RULES FOR GOVERNING RACING AND CONTESTS IN FRANCE, WHICH MAY BECOME THE FOUNDATION FOR RULES TO BE ADOPTED IN ALL OTHER COUNTRIES.—REPAIRS STRICTLY LIMITED.

The Automobile Club de France has proclaimed a code of rules for motor vehicle races and contests which it hopes to make binding for France by disqualifying all competitors in races not authorized by the club from competing in those which the club authorizes.

The new code does not take the place of older regulations, as races and contests have been conducted in the past under no other regulations than those which seemed expedient to the promoters in each instance. No serious opposition to the code is, therefore, expected. It recognizes four categories of vehicles:

Motor cycles, motor cyclettes, voiturettes weighing less than 250 kilograms, and cars weighing more than 250 kilograms, and carrying at least two passengers side by side, each of an average weight of 70 kilograms, this load in the absence of the passengers themselves to be made up with dead weight. In path races, however, and in record breaking attempts the two-seated cars need only carry one person, but in road events the full complement of passengers or the equivalent in dead weight is necessary.

Sport promoters may subdivide the two categories above into as many classes as they please, but the sporting commission is to be the sole judge of the expediency of this classification, as well as of the questions which may arise therefrom.

Pseudonyms Made Perpetual.

The amount of the entrance fee is to be fixed by the promoter, who will decide whether it will be paid back to the starters, and in the latter case the amount will go to the promoter in the event of its not being claimed within a month of the date of the race. Entries are made either by letter or telegram, which must be confirmed by a letter of the same date, and any entry that is not accompanied by the fee will be annulled. Any competitor knowingly sending in a wrong statement will be prevented from starting, and will be liable to a fine.

A competitor may use a pseudonym, subject to its being approved of by the sporting commission, but this pseudonym becomes perpetual, and cannot be changed without the permission of the sporting commission, to whom a written request must be sent, accompanied by a fee of twenty francs. For each race upon the road or track the promoters must choose three commissioners, whose appointment must be approved of by the sporting commission, and these commissioners are entrusted with the carrying out of the programme, and with seeing that the rules are strictly observed, and they are also to settle any dispute that may arise out of the race.

Rights of Commissioners.

The commissioners can either prevent a man from starting, or send him off after the others, when his inexperience or the construction of his car would seem to present a danger to the other competitors. The commissioners have a right (1) to prevent a competitor from starting, (2) to publicly blame a competitor, (3) to impose fines up to a maximum of 200 francs, (4) to disqualify a competitor for a maximum period of a month. In these two latter cases the competitor has a right to appeal to the sporting commission. Should the commissioners deem that a heavier fine ought to be imposed, they can apply to the sporting commission, which has full power to inflict any penalty after taking evidence from those interested.

The starter is appointed by the commissioners, and he alone can judge of the validity of a start. As a general rule the start is given while the vehicles are standing, and they must start by their own means, but in certain cases a flying start will be allowed after an understanding with the commissioners. The start takes place in the order of entry, unless by special arrangement. In races upon the track the start is given to all the competitors at the same time, and this can also be done on the road, or the vehicles may be sent off at regular intervals.

The judge has to be appointed by the commissioners, and his decisions are final.

In distance races the competitor must cover the whole course in order to be entitled to a prize, and in time races the

positions are determined by the number of kilometers covered. When a single competitor starts, a limit of time may be fixed by the commissioners to cover the course. Should a single competitor start in a race, he has the right to the first prize.

Rules Against Jockeying.

In track races observers are placed at the corners to see that one competitor does not interfere with another, and on the road a certain number of observers must be placed where it is necessary to stop the competitors, or compel them to drive at a moderate pace. Any competitor who, in crossing immediately in front of another, or by any other means, may cause a collision, or interfere with that competitor, will be liable to disqualification or a fine, and no excuse will be taken, unless the collision should have been caused by the intervention of a third car. No competitor is allowed to cross the path of another until he is at least two lengths in front.

Advertisements Prohibited.

The cars are not allowed to carry advertisements in races.

In the event of a vehicle being unable to advance by its own power, it can only be drawn or pushed by those accompanying it, and should the competitor avail himself of any other aid he will be disqualified.

The rules regulating motor cycle racing on the tracks are the same as those affecting ordinary cycles.

On the road the cars must make known their approach by the usual means, and at night they must have at least a white and green light in front, and a red light behind.

The competitors are supposed to study the courses they have to follow, and no account is taken of mistakes in the road, unless the route covered should be shorter than that of the official course, in which event the competitor will be disqualified.

Form of Complaints

The commissioners have a right to take a decision with respect to any complaints that may be made by a competitor against another, but the subject of the complaint must always be expressed in writing, and both sides must be heard. Complaints against the classification of competitors and their machines, as well as with reference to the entries and the fees, can be made verbally before the race, but those against unfair manoeuvres, mistakes in the course, or other irregularities, must be made in writing within twenty-four hours after the race. Complaints against the fraudulent starting of competitors in races for which they are not qualified must be made within eight days after the race.

Other clauses relate to the payment of fines, which will be employed by the sporting commission as prizes in subsequent events.

Guarantees of Correct Time.

A special section in these regulations deals with the timing of records, and the appointment of official timekeepers, of which a list is published every year. Applicants must possess watches with first-class certificates from the observatories of Besancon, Geneva, or Kew, and they must also furnish their receipt for the watch. The timekeeper must obtain a new first-class certificate whenever required by the sporting commission, and in any event this must be done every three years. Before appointment they must pass an examination consisting of the timing of ten events up to 500 meters, ten events from 500 meters to 2,000 meters, and two events of twenty or fifty kilometers.

After dealing with the signature of the time sheets, the rules state that the sporting commission recognizes records on either tracks or roads, and each of these categories comprises records of distance and time.

Recognized Distances

The distances offically recognized for records are as follow: On the track, 500 meters, one to a hundred kilometers, the time, being taken each kilometer, and above a hundred kilometers the time being taken every fifty kilometers; and on the road, 500 meters; one to ten kilommeters per kilometer, ten to fifty kilometers per ten kilometers; and a hundred kilometers, the time above this distance being taken every hundred kilometers.

The official distances of the English mile, ten miles, fifty miles, and hundred miles are also recognized. All these records should be made from a standing start though the commission recognizes records for the 500 meters, and from one kilometer to fifty kilometers with a flying start.

Charges for Time-Keeping.

The time records are recognized by the hour, and have no limit, and town to town records are likewise approved.

On the track the records are timed by the lap and the hour up to a hundred kilometers; the kilometers and hours are taken up to 200 kilometers, and the five kilometers and hours above that distance.

The timekeepers are specially requested during these record-breaking attempts to take the times for the half-mile, the mile and the ten miles.

On the roads, records may be made one way up to fifty kilometers, but above

that distance the cars must return to the starting point.

The tariff of an official timekeeper is thirty francs a day with traveling expenses, and he is not permitted to time more than six consecutive hours. These regulations are to come into force on January 1st next, and will then apply to all the road races in France, but in the meantime the promoters of forthcoming races have decided to adhere to the new rules, and the Paris-Ostende contest will be the first to be organized under the new regime.

In a supplement to the code the sporting commission points out that the main object of motor vehicle racing must be to throw light upon the merits and defects of the vehicles, and that it is, therefore, necessary in all contests that require more than one continuous run or series of performances to provide safeguards against having extensive repairs carried on during night time between runs. By allowing such repairs the object of the race would be defeated, and the sporting commission holds that the only way to obtain valuable results is to effectively limit the time for repairs or caretaking to one hour after runs, and one-quarter or one-half hour before runs.

ASCENT OF MOUNT WASHINGTON

The first automobile to make the ascent of Mount Washington, 6,300 feet above sea level, arrived at the summit shortly before noon on August 31, writes a correspondent from Fabyan House, N. H., to the New York Sun:

"In the carriage were Mr. and Mrs. F. O. Stanley of Newton, Mass. They left Newton last Saturday and made their way leisurly to the White Mountains. The climb up Mount Washington began at Pinkham Notch, where they spent last night. The distance of ten miles was covered in two hours and ten minutes. This time included delays in replenishing the water tank. The time is less than half that required by the teams that make the trip with carriages."

The Work in Figures.

This performance must be of considerable interest to intending motor vehicle purchasers. It shows that the Stanley carriage lifted itself and occupants about 6,000 feet, over a distance of 52,800 feet, a steady pull over a grade somewhat steeper than 12 per cent in 130 minutes. As the carriage weighs about 400 pounds and the occupants about 280 and the traction would represent perhaps 20 pounds, the work done equals 4,200,000 foot pounds in 130 minutes or slightly less than 33,000 foot pounds per minute. This being almost exactly equal to one horse power, it seems that a four horse power engine such as is used in the Stanley carriage is capable of producing one full horse power at the rim of the 28 inch driving wheels.

If the exact time lost in replenishing the water supply were given it would be possible to figure out how much more than one horse power the machine really developed.

The correspondent states that Mr Stanley thought that he could make the trip over again in 90 minutes, after having learned the road. At that rate the power development would be 1 13-33 of a horse power at the rim of the wheel.

Water Supply in Steam Wagons.

It is another interesting development that at this rate of power consumption "delays in replenishing the water tank" must be expected within distances of 10 miles. Running on the level the water holds out for a much greater distance, of course, as the same development of power would then represent a much higher mileage.

These are the kind of facts and figures for which the great public are hungry and which are very difficult to obtain, as manufacturers generally consider it necessary to make the public believe that the indicated horse power of the engines is directly comparable with the pull exerted by an equal number of animal horses.

The correspondent at the Fabyan House is entitled to a medal for the good work which he has begun and Mr. Stanley deserves the recognition of the industry and the public for pointing out Mount Washington as a highly desirable testing ground for motor vehicles. It is to be hoped that other manufacturers will follow his footsteps so that it may become general practice to accompany each vehicle sold with a certificate of the time in which an identical vehicle climbed Mount Washington together with details of the performance,

NEWPORT AUTOMOBILE PARADE.

Whether it was the real reason for it or not it is a fact that the great bicycle boom started in the summer of 1894, when James J. Van Alen gave his famous Newport bicycle run, which was participated in by those of the "400" who had taken to wheeling. With this memorable and much discussed event the bicycle craze spread among the upper classes and the columns of newspapers hitherto far from generous to cycling vied with one another in booming bicycling. The consequent craze of 1894, 1895 and 1896 is well remembered.

So it probably will be with the automobile parade gotten up and put through by Mrs. O. H. P. Belmont, assisted by Mrs. Herman Oelrichs and Mrs. Stuyvesant Fish at Newport last Thursday.

Nineteen automobiles, all beautifully decorated with ribbons and flowers after the fashion of the Parisian "auto" parades, assembled at Belcourt. After various evolutions they "moted" through Bellevue avenue to Gray Crag, where an al fresco dinner took place, followed by a run home.

Mrs. Carter and Stuyvesant Le Roy took the prize for evolutions, and Mrs. Herman Oelrichs and Mrs. Burke-Roche second for decorations.

The drivers and guests who participated were:

Mrs. O. H. P. Belmont and J. W. Girard, Jr., Mrs. E. Rollins Morse and W. H. Neilson, Winthrop Rutherford and Miss Fife Potter, Mrs. Burke-Roche and M. M. Shoemaker, Mrs. William Carter and Stuyvesant Le Roy, Mrs. Herman Oelrichs and Max Muller, Miss Scott and Phoenix Ingraham, Mr. and Mrs. W. K. Vanderbilt, Jr., H. R. Taylor and Miss Marie Winthrop, Harry Lehr and Mrs. John Jacob Astor, Clarence Dolan and Mrs. W. R. Travers, O. H. P. Belmont and Mrs. Stuyvesant Fish, Mrs. G. B. De Forest and F. Baldwin, Col. John Jacob Astor and Mrs. Adolf Ledenburg, Mrs. J. R. Drexel and Reginald Ronalds, Marquis de San Vito and Miss Clapp, Mr. and Mrs. G. Van L. Meyer, H. Roger Winthrop and Mrs. Clarence Mackey, and Mr. and Mrs. Joseph Widener.

MOTOR TANDEM TRACK RACE.

New York, Sept. 4.—The speed attained and the intense excitement aroused by to-day's five cornered motor cycle race of twenty-five miles at Manhattan Beach promise great popularity in the future for this new sport, which bids fair to become a favorite form of motor speed test apart from its standing as an independent racing game. Already enthusiastic suggestions are being made of motor cycle race meets with contests at various distances after the manner of a bicycle tournament.

Prophecies are made that not only will motor makers seek this form of comparative test for their motors; but that automobile owners will take up the game and have their motor racing machines just as cruising yachtsmen have their racing sloops and horsemen their track trotters and runners as well.

Previous attempts at motor pacing machine racing have been successfully made at Waltham, where an Australian pursuit race was run by four machines, and at Baltimore, where a distance race was held. To-day's event, however, was the first trial on an extensive scale of the game, popular already in France.

All American motor cycle records from two miles to the end were broken. The gait up to five miles, which were run in 7:45 4-5, was terrific. From this point, however, the leaders slackened their speed somewhat, having the race well in hand. Miller and Judge went the distance in 39:59, about a 1:36 clip for the mile; Stinson and Stafford, second, in 41:17 2-5; Caldwell and Ragan, third, in 42:30 3-5; and Waller and Steenson, fourth. The French world's record is 39 miles, in the hour made recently in Paris, an average of about 1:32 for the mile. The times made by Miller and Judge follow. All but one mile are American records.

Miles.	Time.	Miles.	Time.
1	1:36 2-5	13	20:21 1-5
2	3:07 3-5	14	22:00 3-5
3	4:40 1-5	15	23:37
4	5:14 4-5	16	25:13 4-5
5	7:45 4-5	17	26:52 2-5
6	9:19 3-5	18	28:28 3-5
7	10:53	19	30:06 2-5
8	12:27	20	31:43 1-5
9	13:59 4-5	21	33:20 1-5
10	15:33 4-5	22	34:56 4-5
11	17:06	23	36:36
12	18:43	24	38:17 3-5
		25	39:58

The five tandems were manned respectively by Miller and Judge, Fournier and Corbe, Waller and Steenson, Caldwell and Ragan, and Stinson and Stafford.

Miller and Judge's tandem was built by Jaillu & Co., of Paris, all the others being Waltham Manufacturing Co.'s product. Caldwell and Ragan were handicapped by a machine of rather ancient patterns. De Dion 1¾ horse-power motors were used in all, though the result proved that the improved form of one used by Miller and Judge was on this occasion at least far more effective than the others. It was fitted with a muffler so that it ran silently. The particular advantage gained was claimed to be through the carburettor. In the Waltham motors the gas entered the cylinder cold, while in the French one it entered the carburettor warmed from a pipe leading from the muffler so that there was a more constant and effective explosion.

It is learned that the improved form is the one which the Waltham company proposes to use regularly if tests, as today's race, prove its superiority for all purposes.

Miller brought another of these new patent carburettors from Paris, which will be fitted to the new machine to be built for him by Oscar Hedstrom.

Miller and Judge gained a lead of 20 yards on Stinson and Stafford in the first mile, which was increased gradually to 150 yards at the end of the fourth mile and in the ninth mile Stinson and Stafford were lapped, the course being a third of a mile in length. Fournier and Corbe fell in the fifteenth mile through a tire going down, and Waller and Steenson, whose motor had gone wrong early in the race, returned to the contest after the fourth money, the prizes being $250, $125, $75 and $50.

ROAD FREIGHTING IN FRANCE

The handling of freight by motor vehicles is in many respects a more important phase of automobilism in Europe than here, and some of its problems, while more urgent, are also more readily solved in those older communities where all the street and roads are in good condition all the year around. Much of the work done by railroad here requires individual hauling in England and France, and the large steam freight vans have therefore occupied the attention of English and French engineers almost as early as the construction of pleasure carriages. The accompanying illustration shows the well known Train Scotte arranged for freight purposes which is enjoying considerable popularity in France. Similar trains are made for passenger and mixed traffic and are arranged to travel with considerable speed. The freight trains have an average speed on good roads of 4 1-3 miles per hour.

UNIVERSAL MOTOR VEHICLES

VEHICLES GOOD FOR ALL PURPOSES NOT TO BE EXPECTED.—A SORE POINT IN GASOLENE MOTOR TRACTION WHICH IS BEST OBVIATED AT PRESENT BY SPECIAL CONSTRUCTION FOR EACH CLASS OF MOTOR VEHICLE WORK.

One of the most important requirements of motor vehicles, and at the same time one which presents the greatest difficulties when gasolene explosion motors are used, is that the motor shall work satisfactorily at a very small power development while yet capable of a power many times greater.

One aspect of this requirement is generally recognized. It is understood that there must be a high reserve power for emergencies.

The Slow Speed Problem.

But, looking at the same problem from the other side, it is seldom realized how small the power is which the motor should be capable of generating in a satisfactory manner to insure pleasant driving with a light vehicle at slow speed over smooth and level roads.

To its superiority in this respect the steam carriage owes practically all the advantage which it possesses over other types, aside from the light weight which gives to it in common with the explosion motor carriages a preference over electric vehicles for many classes of work.

At or near its highest power the gasolene explosive motor is very satisfactory and runs, in its best types, without an objectionable degree of either noise, odor or trepidation, but the gasolene motor, which, with a high reserve capacity, combines reliability and absence of odor at slow speed of the engine shaft has not so far been in evidence, nor has there yet been produced a powerful gasolene motor from which light work may be obtained by means of reduction gearing—without noise and trepidation.

Diversity of Patterns Desirable.

By means of suitable combinations in regard to the weight of vehicles, the power of motors, the number of cylinders, the character of gearing, the perfection of lubrication, the metal spring and tires and by skill of the driver, most of the inconveniences arising from the lack of flexibility in explosion motor power may even now be reduced to a minimum, but it is apparent that for the best results the public must look to inventions in construction of gasolene motors and power transmission which have not yet seen the full light of day.

Until they shall have been commercially developed it remains highly necessary for the public to see to it that the vehicles which they purchase are specially constructed for the work they are intended for by the proper combination of the various features above referred to.

Eventual Range of Power.

The universal motor vehicle—good for light driving on smooth level roads as well as for heavy hauling over steep sandy hills—is not yet in existence. Probably it never will be; but there is reason to suppose that it will in time come at least as near to it as any one combination of horses and wagon now available.

FREIGHT OR PLEASURE VEHICLES.

It is for freight-hauling purposes rather than for the carrying of great numbers of passengers, that some form of motor vehicle seems likely first to come into widespread use, says Iron Age, but adds: It is not intended here to disparage the use of the automobile for carrying passengers, either under private ownership or for public hire. Indeed, thus far the principal demand has been for passenger vehicles. But the urban freight traffic is destined to reach a larger volume than the passenger traffic, just as has been the case on steam railways, and the investigator who fails to take this fact into consideration will find that he has made a mistake.

Perhaps the Iron Age underrates somewhat the well-established observation that those who purchase for luxury purposes are less exacting in some respects than those who have mere utility purposes in view. Complete reliability of motor vehicle mechanism is for the latter a factor of economy and will be considered in the first line. Reliability is for freight traffic what safety is for passenger transportation. And because today reliability is far from being fully realized in motor vehicle construction while personal safety is practically at the command of the user, the demand for

motor vehicles for individual or public passenger traffic will for some time largely exceed the demand for freight motor wagons.

But it is probably true that—reliability once established beyond contradiction—the demand for freight wagons of all kinds will leap into immediate prominence and will overshadow the motor carriage business in volume.

The same view may undoubtedly be taken in regard to such uses of motor vehicles for passenger traffic in which the utility aspect predominates, such as omnibus lines and all forms of transportation for hire.

DRAFT OF HEAVY VEHICLES

The draft of a vehicle depends primarily upon two distinct series of conditions, namely, the type, nature of construction and general motive state of the vehicle itself, and the conditions of the road upon which it is run. If an absolutely perfect roadway could be provided, the draft of vehicles would be equal to the power absorbed by the friction of its moving parts and by the rolling contact of the wheels over a smooth surface, plus that necessary for the ascent of grades. The power absorbed by friction of axles, when both axles and their boxes are of metal and kept constantly well oiled, is, it has been calculated, about four per cent of the load exclusive of the wheels, multiplied into the ratio of the mean diameter of the axles to the mean diameter of the wheels, multiplied again into the distance the vehicle travels in a given time. Thus in an example for illustration only, and without application to any special vehicle, the mean diameter of the motor wheels being forty inches, the load including weight of the vehicle (exclusive of the wheels) being 4,000 lbs., and the mean diameter of the axles being 2½ inches, the power absorbed by the friction of the axles at three miles per hour would be .04x4,000 (lbs.) x25-40x3x5,280 equals 158,400 foot-pounds per hour, or .08 of one horse-power. The friction engendered by contact of the wheels with the road surfaces would be, on a smooth roadway, much less than this, the exact amount being impossible to determine except by experiment in each individual case. In the above rough calculations, air and wind resistance are not taken into account.

Comparing the sum of these theoretical losses of power with what is found by experiment to be the actual power consumed on the average on what are considered to be good roads, the difference is surprising. The power required in the latter instance is on an average perhaps one-third of one horse-power per ton of load transported say three and one-half miles per hour. This wide difference may be ascribed in a large measure to the construction of vehicles used for transportation of loads, partly to slipshod and unscientific lubrication, but mainly to the imperfect road surfaces usually encountered.

The general principles upon which the draft of heavy vehicles depends are qu'te imperfectly understood, although they have been made the subject of elaborate investigation and experiment by several scientists and philosophers, especially by Morin (France), who in his valuable treatise on mechanics treats the matter exhaustively. Wheels acting upon road surfaces may be considered as simple rollers. Coulomb has demonstrated that (1) the resistance of hard rollers passing over hard, even surfaces is proportional to the load; that (2) it is in the inverse ratio of the diameter of the rollers; and that (3) it is so much the greater as the width of contact is decreased. But as roadways are seldom even surfaces, it is evident that the theoretical laws determined by Coulomb cannot be expected to be rigidly applied to them.

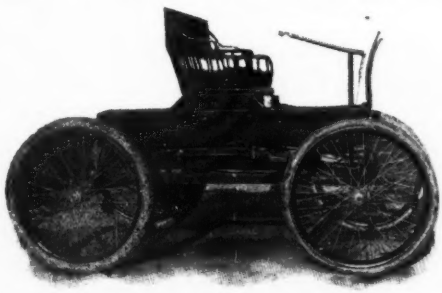
Under the direction of the French government Morin performed an extensive series of experiments to ascertain the laws which control the draft of vehicles, employing for the purpose all sorts of moving mechanisms and propelling them over all sorts of roads, dry, smooth, muddy, stony, rutty, level, hilly, etc. He found that the draft over a given roadway is proportional to the load, and that it varies in the inverse ratio of the diameter of the wheels, thus showing that the laws of Coulomb as applied to hard rollers upon hard, even surfaces also apply upon rough or yielding surfaces, in so far as they involve the diameter of the rollers and the load. But upon the point of width of tire it was found that the coincidence failed. Upon soft foundations the draft increases as the width of tire decreases, while on the solid roads the draft is little influenced by the matter of width. For use on farms, and in soft earth, Morin maintained that the width of rims should be four inches. It was further found that resistance in-

creases with inequalities of surface, the stiffness of the vehicle and speed upon hard roads, while upon soft bottoms it does not so increase with speed. Wheels of large diameters and narrow tires injure roads less than those of small diameters and narrow tires, and the concentration of load upon two wheels having wide rims is more injurious to roads than the distribution of the same load upon four narrow-rimmed wheels.

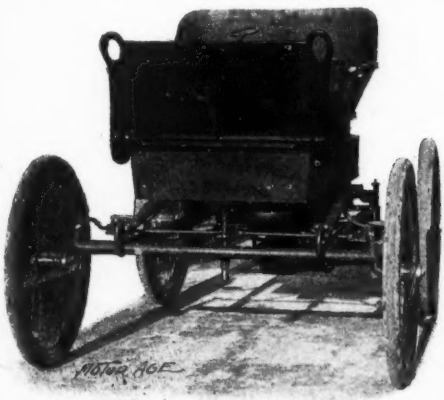
PLANS OF SYRACUSE FIRM.

C. F. Saul and William Van Wagoner of Syracuse, N. Y., propose to build and market mortor vehicles in the near future. They will make both electric and gasolene motor wagons.

Mr. Saul is the president of the Barnes Cycle Company, now absorbed in the



American Bicycle Company, and is also a carriage manufacturer and dealer of high commercial standing. Mr. Van



Wagoner has been identified with the bicycle industry since its beginning, and has for several years been responsible for many of the successful features of shop practice in the Barnes concern. The mechanical construction of the vehicles to be manufactured is the result of his efforts.

In general appearance the electric and the gasolene wagons will be alike. It is the intention to fit either wood wheels or suspension wheels, at option, in both cases with air tires of large cross-sectional diameter.

The accompanying engravings show two views of the electric experimental wagon which Mr. Wagoner has tested to his satisfaction. This design will, however, be modified at several points. In regard to the gasolene motor wagons the firm gives no further information, except to state that simplicity in operation will be a prominent characteristic.

OPINIONS ON TIRE QUESTION.

The troubles of the rubber manufacturer over the tire problem in the early days of bicycling promise speedily to be forgotten in the presence of the new problem of how the automobile shall be tired. I have met not a few rubber superintendents lately, each of whom is confident of being able to evolve the winning automobile tire, all of them keeping a pneumatic tire foremost in mind. As one of them said: "We have an entirely new proposition to deal with. Until the automobile came in we knew the pneumatic tire only in the form suited to the bicycle and the lightest forms of vehicles. The first thought of the average manufacturer has been to put precisely the same kind of tire upon the automobile, only increasing its size and strength. But there will have to be some radical changes of construction before a pneumatic tire will be produced that can stand the strain of these new vehicles."

A very pertinent question in this connection is whether, after all, the pneumatic tire is going to be the standard for automobile equipment. G. Henry Condict, chief engineer of the Electric Vehicle Company, told me once that he thought a mistake had been made in ever offering for public hire a pneumatic tired electric cab. Other cabs on the streets, with solid rubber tires, seemed to afford the public full satisfaction, and had the first automobiles seen in New York not been equipped with pneumatics, everybody would have been pleased with the easy riding effects of solid tires on vehicles of this type. But passengers having once tried the pneumatic tires, they hesitated thereafter to get into automobiles with solid rubbers.—India Rubber World.

STREETS OF GOLD

are the dream of the righteous, but our cobble stone and granite pavements may be made to seem as such and the fancy of the dreamer made the reality of the present by fitting all Motor Cabs and Carriages with resilient, durable, practically and scientifically correct pneumatic tires. Springs tend to cure vibration and in the curing give birth to tiresome bouncing and jolting. Pneumatic tires prevent vibration and save the need of cure. The learning of this lesson in the bicycle industry was a long and expensive task. Motor Vehicle makers can profit by the experience and start right. Pneumatic tires unqualified, however, may mean but little. Get the best.

DIAMOND TIRES FOR THE MOTOR VAN; GREATEST BLESSING AWARDED TO MAN

We have carefully studied the needs of all classes of Automobiles and turned all the energies of our working staff, all the resources of our thoroughly equipped factory to the task of providing pneumatic tires to fill every need that shall be advanced by the Motor Vehicle Industry. We have not been satisfied to produce tires which will pass cursory judgement, but have been successful in our original endeavor to place on the market tires which are not only fast and lively but strong, lasting, readily applied and easily repaired. Our stock is large and our variety of patterns apace with the requirements of the trade.

DIAMOND TIRES, LARGE, MEDIUM, SMALL, SUIT THE FANCIES, WISHES, NEEDS OF ALL

The stock sizes range from 28 to 50 inches and in tube diameters we can supply anything from 1½ to 5 inches.

The Diamond Rubber Co.

AKRON, OHIO